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Introduction

I've said it before... "weather (environment) significantly influences crop growth and development." The 1998 growing season certainly provided us with an ample supply of environmental conditions that affected (both positively and negatively) crop growth and development. Too cool, too warm, too wet, too dry, high winds, hail... all played significant roles in influencing the 1998 crop. However, given all the adverse conditions that occurred throughout the season, the crop still managed to "weather" them pretty well and yields have been remarkably good considering all factors. Let's take a look at what happened during the 1998 growing season and attempt to explain the "good" and the "bad."

The October Crop Report estimated Iowa corn and soybean yields at 143 and 46 bushels/acre, respectively. For corn, this represents a five-bushel increase over lasts year's state average yield of 138 bushels/acre. One can expect these numbers to be adjusted somewhat by subsequent reports. The yield relationship between corn and soybean varies between regions and is a reflection of the variation in growing season in the different parts of the state.

Yield estimates, as of October 9, are presented by Crop Reporting District in Table 1. Yield variability is the result of many factors. The major negative factors in 1998 were heavy rains, hail, cool temperatures in June, limited rainfall and warm temperatures in July and August, high winds, weeds, stalk rots, etc. The importance of each varied greatly depending on region of the state.

Table 1. Iowa corn and soybean yields in bushels per acre based on October 9, 1998 estimates (USDA-NASS).

	Yield Per Acre (bushels)*	
District	Corn	Soybean
Northwest (NW)	145 (139)	48 (46)
North Central (NC)	149 (144)	47 (44)
Northeast (NE)	144 (141)	47 (45)
West Central (WC)	140 (131)	45 (45)
Central (C)	145 (141)	45 (47)
East Central (EC)	144 (139)	52 (50)
Southwest (SW)	138 (132)	39 (44)
South Central (SC)	128 (126)	40 (45)
Southeast (SE)	140 (140)	46 (50)
STATE	143 (138)	46 (46)

*1997 yield in parentheses. Yields are rounded.

Early Season

Following a rather mild and moist winter, March entered like a "lion," providing the unusual distinction of actually being cooler than the month of February. March precipitation was above normal making this the wettest March since 1991. Frost penetration in March was fairly shallow, and saturated soils generated some fears of flooding. None the less, fertilizer applications began and by the end of March were just under half complete (including fall applications). The wet conditions continued into April and farmers were beginning to get anxious to get fieldwork underway. Subsoil moisture reserves were adequate to excessive for much of the state going into the planting season. As we will see later, subsoil moisture will serve as a key factor in carrying the corn crop through the pollination period and into early grain fill. Tables 2 and 3 provide rainfall and growing degree information.

Table 2. 1998 Iowa regional crop season precipitation in inches from April 1 to date indicated (cumulated and departure from average).*

District	May 4	May 31	July 5	August 2	September 6	October 4
NW	4.2/1.2	6.9/0.7	11.9/0.9	15.0/0.7	18.3/-0.3	20.9/-0.6
NC	4.3/0.8	7.9/0.8	15.8/3.4	17.6/1.4	22.6/1.8	25.7/1.7
NE	4.8/1.1	8.5/1.2	17.9/5.6	19.1/3.1	26.2/5.3	30.3/6.0
WC	5.0/1.6	9.8/2.6	20.7/8.4	23.5/8.0	27.4/7.6	29.9/7.0
C	3.3/-0.4	8.1/0.7	19.0/6.0	21.0/4.4	25.4/4.1	28.8/4.4
EC	4.3/0.5	7.8/0.4	16.0/3.4	17.1/0.4	23.5/2.3	29.3/4.7
SW	3.4/-0.3	8.1/0.4	19.6/6.6	23.3/6.5	26.0/4.4	28.9/3.6
SC	4.0/0.0	8.9/1.1	16.4/3.4	18.9/2.0	23.1/1.4	28.0/2.5
SE	5.4/1.3	9.3/1.5	17.6/5.2	19.2/2.7	24.8/3.7	31.9/6.9

*Adapted from Iowa Agricultural Statistics Reports.

Table 3. 1998 growing degree days from May 1 to dates indicated (cumulated and departure from average).*

District	May 31	July 5	August 2	September 6	October 4
NW	454/111	1035/0	1657/-51	2405/-1	2825/109
NC	467/133	1073/65	1686/38	2422/111	2841/229
NE	467/134	1088/92	1704/69	2461/149	2883/260
WC	489/115	1126/13	1792/-24	2600/38	3051/143
C	484/120	1116/31	1769/-3	2562/68	2995/161
EC	489/130	1147/72	1808/52	2609/130	3046/221
SW	512/119	1196/25	1898/-16	2763/49	3245/149
SC	515/122	1204/32	1911/-8	2779/62	3263/162
SE	554/154	1309/126	2051/132	2950/238	3471/364

*Adapted from Iowa Agricultural Statistics Reports.

Heavy rains in early April predominated over much of the state. By mid-month, rivers and streams in southeastern Iowa were at or near flood stage. Temperatures in early April were cool to start, but gave way to more seasonal temperatures and lighter precipitation through the remainder of the month. These cool, wet conditions kept oat seeding progress in check, resulting in a seeding pace that was well behind normal for this time period. Soil temperatures by mid-April were in the upper 40s to low 50s across much of the state. The cool, wet conditions were all too familiar to many farmers across the state. Warmer and drier conditions in the latter half of April and on into May enabled farmers to finally get a start on corn and soybean planting (Table 4), particularly in central, north central, and southwestern Iowa. In many cases, however, field conditions were less than ideal and farmers were forced to work only in drier fields or around wet spots. Soil temperatures at the four-inch depth were in the low fifties in extreme eastern Iowa and in the upper fifties and low sixties elsewhere.

Table 4. 1998 Iowa corn planting progress by week for various crop reporting districts.*

	Percent of corn planted by				
District	April 26	May 3	May 10	May 17	May 24
NW	3	63	96	100	100
NC	2	65	97	99	99
NE	7	36	72	93	98
WC	5	32	93	98	100
C	1	42	93	97	100
EC	1	5	40	89	98
SW	8	33	81	87	98
SC	2	10	38	55	82
SE	0	3	10	51	92
State**	3/11	38/34	77/53	91/69	98/86

*Adapted from Iowa Agricultural Statistics Reports.
**Percent complete 1998/percent complete 1970-97 average.

Warmer and drier conditions by mid-May enabled farmers to make good progress on corn and soybean planting. Except for southeast and some parts of south central Iowa, planting progressed at a very rapid pace. While these areas were struggling once again with wet conditions, other parts of the state actually were in need of some rain to activate herbicides and help with germination. The warm weather also pushed the germination and emergence pace well ahead of normal. In many areas of the state, both corn and soybeans were emerging within a week's time following planting. Unfortunately, however, warm conditions, such as were experienced in mid-May, can and usually do trigger severe weather. There was no exception to this rule in 1998 as severe storms wreaked havoc over much of the state on several occasions. Heavy rains, large hail, high winds, and tornadoes were spawned from these storms that either delayed fieldwork progress or damaged the newly emerging crops.

By the end of May, planting progress was nearly complete for corn and very nearly complete for soybeans. Progress was 18 to 20 days ahead of normal for both crops. The Iowa Agricultural Statistics Office (IAS) reported that 84% of the corn crop was rated in good and excellent condition while 71% of the soybean crop was rated in good and excellent condition. For the most part, the 1998 growing season appeared to be getting off to a great start.

Mid-Season

Early June was ushered in with unseasonably cool temperatures. Temperature extremes ranged from a high of 90 degrees in west central Iowa to a low of 37 degrees in northeast Iowa (IAS). Precipitation amounts were light to moderate across the state and the cool, wet weather slowed crop growth and development dramatically. There were many reports of "yellow corn" resulting from the excess moisture and cool temperatures and the northern third of the state was hoping for warmer, drier weather to get the crop growing again. Parts of west central, central, southwest, and south central Iowa were replanting crops that had been damaged by hail from earlier storms. In many cases, the excessively wet conditions precluded any chances for replanting. Farmers were forced to accept the thin stands due to lack of other alternatives.

The cool, wet conditions persisted for much of the remainder of the month of June. Crops essentially were at a standstill. These conditions also prevented any replanting from occurring, as well as slowing the progress of normally scheduled events. Inability to apply herbicides or cultivate gave weeds a good opportunity to encroach in many fields. Weed pressures were especially strong in fields that had been thinned by hail or other storm damage. This would become even more noticeable as the season progressed even further.

By mid-June, almost daily rains were beginning to take their toll on the crops. Farmers were beginning to wonder if the rains would ever stop. Large ponded areas were common in many fields. Yellow, uneven corn and soybeans were common in most fields. Statewide, topsoil and subsoil moisture status was rated at nearly 75% surplus. The corn crop condition had deteriorated to 68% good and excellent and the condition of the soybean crop dropped to 63% good and excellent (IAS).

July finally brought a return to warmer conditions, but along with that came more severe storms. Damage was mostly from high winds that caused damage from west central to southeast Iowa (June 29th storm). Structural damage to buildings, tree damage, and damage to corn from "green snap" were common occurrences in these areas. Additional storms near mid-month caused more green snap in northwest, central, and east central Iowa. The warmer weather did help dry fields and crops that were not yellow or standing in water began to show signs of rapid growth. Tassel emergence was noted in many fields by the 4th of July.

The latter half of the month witnessed much warmer and humid weather. Crop development was progressing rapidly and farmers in the northern third of the state were looking for some rain to help with pollination. Silking pace by districts is presented in Table 5. Overall, silking progressed well ahead of normal with nearly half of the state corn crop silked by July 19th. This was at least nine days ahead of the five-year average of 16% (IAS). Note Table 6 for a comparison of silking dates for the past five years. By the end of July, 69% of the corn crop and 63% of the soybean crop had been rated good and excellent (IAS).

Early August was cooler than normal. Precipitation was scattered and in many areas farmers were wishing for a "good rain." Wide variations in the conditions of the crops were being reported across the

state. As mentioned previously, areas that suffered from earlier storm damage were now experiencing significant weed problems. By mid-month, several areas in the state were beginning to exhibit signs of dry weather stress. Fields that managed to escape the wrath of Mother Nature, however, were looking excellent. The corn crop was beginning to make very rapid progress and by the end of the month, 71% of the corn crop had reached the dent stage (11 days ahead of normal) and 11% was mature. The crop condition was rated at 69% good and excellent for corn and 76% good and excellent for soybeans (IAS).

Table 5. 1998 corn silking progress by week for various crop reporting districts.*

	Percent of corn silked by			
District	July 19	July 26	August 2	August 9
NW	55	89	99	100
NC	67	92	96	100
NE	31	80	93	99
WC	43	84	94	97
C	64	91	98	99
EC	43	81	87	99
SW	70	84	96	98
SC	21	64	84	97
SE	22	69	86	96
State**	49/16	84/44	94/71	99/87

*Adapted from Iowa Agricultural Statistics Reports.
** Percent complete 1998/percent complete 1992-97 average.

Table 6. A comparison of 1994 through 1998 silking pace of the Iowa corn crop.*

Silked by	1994	1995	1996	1997	1998
July 10	10	---	---	---	---
July 17	52	---	---	---	---
July 20-24	82	14	4	11	49
July 27-31	98	60	42	70	84
August 3-8	---	85	77	92	94
August 10-15	---	96	93	99	99

*Adapted from Iowa Agricultural Statistics Reports.

Late Season

Dry, almost summer-like conditions prevailed for much of September. Both corn and soybean crops were progressing rapidly. The first week of September saw corn silage and seed corn being harvested in some parts of the state. In many areas of the state, early death of corn plants was being observed. The many stresses the crop had experienced throughout the season were primarily to blame. Weakened plants also were more susceptible to leaf and stalk diseases and these, too, took their toll. With the speed at which the crop was maturing, fears of an early frost were nonexistent.

By mid-September, corn and soybean harvest was underway. Some areas of the state continued to experience moisture stress from the lack of rainfall and warm temperatures. The corn crop was drying rapidly and many farmers were reporting corn grain moisture below 20% at harvest. Additional reports of green snap damage continued to trickle in as farmers began to realize the full extent of the damage. Early yield reports were unbelievably good for both corn and soybeans. Heat unit accumulation through September averaged 100 to 300 growing degree units ahead of normal. The above average heat unit accumulation, coupled with adequate moisture, explained much of the yield response. Fields that suffered from severe weather damage (hail, high winds, ponding, and excess moisture) told a different story, however. Sub-100 bushel/acre yields were being reported in many areas. The overall effect on total production for the state is yet to be seen.

In summary, the 1998 growing season provided a wide range of conditions and events that made it memorable. Roughly 80% of the year-to-year yield variability can be explained by weather. The 1998 growing season added further credibility to that claim. Now we can only wait to see what 1999 has to offer.